



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/031,842	06/10/2002	Volker Becker	10191/2169	8531
26646	7590	02/26/2004	EXAMINER	
KENYON & KENYON ONE BROADWAY NEW YORK, NY 10004			AHMED, SHAMIM	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 02/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/031,842	BECKER ET AL.	
	Examiner	Art Unit	
	Shamim Ahmed	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 33-67 is/are pending in the application.
- 4a) Of the above claim(s) 33-48 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 49-67 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 January 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/22/02</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group II, claims 49-67 filed on 11/26/03 is acknowledged. The traversal is on the ground(s) that both the claimed device and method have the common feature of producing a magnetic field that is one of a static and time-wise varying and that is between (parallel to the connection line of) the plasma source and the substrate.

This is not found persuasive because it is not claimed that the device is producing a magnetic field, which is parallel to a direction defined by a connecting line of the substrate and the plasma.

Therefore, both the device and the process of using the device are not sharing a common technical feature.

The requirement is still deemed proper and is therefore made FINAL.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: Figure 1 includes a reference sign "B", which is not described in the specification. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 49-51, 53-54, 56, 59 and 65 are rejected under 35 U.S.C. 102(e) as being anticipated by Lymberopoulos et al (6,247,425).

As to claims 49-51, Lymberopoulos et al disclose a process for etching a semiconductor substrate using inductively coupled plasma (ICP) source (110), which is generating a high-frequency electromagnetic alternating field (140) (col.1, lines 10-12, col.3, lines 45-53).

Wherein, the inductively coupled plasma composed of reactive particles by the action of the high-frequency electromagnetic alternating field on a reactive gas (col.5, lines 30-42).

Lymberopoulos et al also disclose that the magnetic field (140) confines the plasma along the axial direction to the substrate and generally perpendicular to the wafer surface (col.5, lines 50-64 and figure 5), which reads on the limitation of producing a magnetic field in a direction, which is parallel to a direction defined by a connecting line of the substrate and the inductively coupled plasma.

Art Unit: 1765

Lymberopoulos et al further disclose that the magnetic field is varied with time (col.6, lines 23-25).

As to claims 53-54, Lymberopoulos et al teach that the inductively coupled plasma is generated with a steady-state frequency of 13.56 MHz (col.4, lines 45-48).

As to claim 56, Lymberopoulos et al teach that the process parameter includes the pressure of 5 mTorr (about 6.7 μ bar) and plasma source power of about 500 watts (col.5, lines 65-66).

As to claim 59, Lymberopoulos et al teach that a variable adjustable high-frequency power is produced and periodically varied and pulse (col.8, lines 49-61).

As to claim 65, Lymberopoulos et al teach that pulsing of the magnetic field is correlated with time and also correlated with pulsing of the source power (col.2, lines 53-61 and col.9, lines 22-42).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation

Art Unit: 1765

under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 52,55 and 57, rejected under 35 U.S.C. 103(a) as being unpatentable over Lymberopoulos et al (6,247,425) in view of Applicant's admitted prior art.

Lymberopoulos et al discussed above in the paragraph 4 but fail to disclose that the magnetic field strength is between 10 –100 mTesla.

However, Applicant's admitted prior art discloses that it is conventional to have a magnetic field having a strength in the range of 10 to 100 mTesla in order to have sufficient guidance function during the plasma etching process (see page 4, line 30- page 5, line 2).

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of claimed invention to combine the teaching of Applicant's admitted prior art into Lymberopoulos et al's process for efficiently etching a substrate with sufficient guidance for the electrons during the plasma etching as taught by the Applicant's admitted prior art.

As to claim 55, Applicant's admitted prior art teach that the inductively coupled plasma having a high-frequency electromagnetic alternating field is suitable for alternating etching and passivating steps (see page 5, lines 15-20).

Art Unit: 1765

8. Claims 58,60-64,66-67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lymberopoulos et al (6,247,425).

Lymberopoulos et al discussed above in the paragraph 4 but fail to disclose the exact value of pulsing the magnetic field.

However, Lymberopoulos et al teach that the magnetic field is pulsed from zero to six (col.9, lines 14-18) and the magnetic field parameters could be adjusted to within 20% (col.9, lines 43-64).

It would have been obvious to one skilled in the art to optimize, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum value of a result effective variable involves only routine skill in the art. *In re Boesh*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

As to claim 66, Lymberopoulos et al teach that the magnetic field is first applied before a high-energy power pulse of the ICP coil for the coupling of the plasma power (col.9, lines 15-18).

As to claim 67, Lymberopoulos et al teach that the electric power is pulsed due to the pulsing action of the magnetic field and thereby producing a reduction in average electron temperature while not significantly reducing the electron density (col.9, lines 9-33 and lines 57-64).

Therefore, it would have been obvious to have a greater pulse/pause ratio of the magnetic field than the pulse/pause ratio of the power pulse because the higher pulse/pause ratio of the magnetic field would provide enough pulsing into the electric field for maintaining the electron density at constant level in order to reduce the chances

Art Unit: 1765

of damaging the substrate by 99.9% during the processing as taught by Lymberopoulos et al.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shamim Ahmed whose telephone number is (571) 272-1457. The examiner can normally be reached on M-Thu (7:00-5:30) Every Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Shamim Ahmed
Examiner
Art Unit 1765

SA
February 14, 2004